
प्रबलित चावल — विशिष्टि

Fortified Rice — Specification

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Foodgrains, Allied Products and Other Agricultural Produce Sectional Committee had been approved by the Food and Agriculture Division Council.

Rice is one of the most widely consumed grains in the world. India is ranked second with 106.5 million metric tonnes of rice consumption in the year 2020-2021. This makes rice an appropriate fortification vehicle for populations that suffer from micronutrient deficiencies. India suffers from a huge burden of under-nutrition and micronutrient malnutrition across the spectrum of age, sex and socio-economic background. Micronutrient malnutrition severely impairs the quality of life of the Indian population specifically in impoverished strata of the Indian population. Out of all the micronutrient deficiencies in India, iron, vitamin A and iodine deficiency disorders have the most overwhelming impact. In order to address the issue of micronutrient deficiencies, Government of India is promoting the consumption of fortified rice containing iron, folic acid and vitamin B₁₂, through various social security programmes like Public Distribution System (PDS), Integrated Child Development Services (ICDS), and National Programme of Mid-Day Meal in Schools (MDMS). It was, therefore, felt important to formulate an Indian Standard on specification for fortified rice to ensure the quality and safety of fortified rice distributed through various social security programmes and in open market.

In the formulation of this standard, due consideration has been given to the provisions of the *Food Safety and Standards Act*, 2006 and the Rules framed thereunder and the *Legal Metrology (Packaged Commodities) Rules*, 2011. However, this standard is subject to the restrictions imposed under these, wherever applicable.

The composition of the Committee responsible for formulation of the standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FORTIFIED RICE — SPECIFICATION

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for fortified rice.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
		16287 : 2015/ ISO 16050 : 2003	Foodstuffs — Determination of aflatoxin B ₁ , and the total content of aflatoxins B ₁ , B ₂ , G ₁ and G ₂ in cereals, nuts and derived products High performance liquid chromatographic method
		16639 : 2018/ ISO 20633 : 2015	Infant formula and adult nutritionals — Determination of vitamin E and vitamin A by normal phase high performance liquid chromatography
460 (Part 1) : 2020	Test sieves — Specification: Part 1 Wire cloth test sieves (<i>fourth revision</i>)	16640 : 2018/ ISO 20634 : 2015	Infant formula and adult nutritionals — Determination of vitamin B ₁₂ by reversed phase high performance liquid chromatography (RP-HPLC)
1070 : 1992	Reagent grade water — Specification (<i>third revision</i>)		
2491 : 2013	Food hygiene — General principles — Code of practice (<i>third revision</i>)	17782 : 2021	Fortified rice kernels — Specification
4333	Methods of analysis for foodgrains	ISO 2528 : 2017	Sheet materials — Determination of water vapour transmission rate (WVTR) — Gravimetric (dish) method
(Part 1) : 2018	Refractions (<i>third revision</i>)		
(Part 2) : 2017/ ISO 712 : 2009	Determination of moisture content (<i>second revision</i>)	ISO 15105-2 : 2003	Plastics — Film and sheeting — Determination of gas-transmission rate — Part 2: Equal-pressure method
(Part 5) : 1970	Determination of uric acid		
12650 : 2018	Textiles — Jute bags for packing 50 kg foodgrains — Specification (<i>third revision</i>)	EN 14164 : 2014	Foodstuffs — Determination of vitamin B ₆ by high performance chromatography
14818 : 2017/ ISO 24333 : 2009	Cereal and cereal products sampling (<i>first revision</i>)		
16208 : 2015	Textiles — High density polyethylene (HDPE)/polypropylene (PP) woven sacks for packaging 10 kg, 15 kg, 20 kg, 25 kg and 30 kg foodgrains — Specification		

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Fortified Rice Kernels (FRK) — Rice shaped kernels containing vitamins and minerals produced through extrusion or whole rice kernels coated with vitamins and minerals.

3.2 Fortified Rice — Blend of fortified rice kernels and polished raw or parboiled rice in the ratio of 1 : 100 or 2 : 100 with a tolerance limit of ± 10 percent of the declared ratio.

3.3 Vitamin and Mineral Premix — A combination of micronutrients (vitamins and minerals) in desired proportion ready for use as fortificant in the manufacturing of fortified rice kernels.

3.4 Foreign Matter — Any extraneous matter other than food grains, comprising of:

- a) Inorganic matter, such as glass and metallic pieces, dust, sand, gravel, stones, dirt, pebbles, lumps or earth, clay, mud and animal filth etc; and
- b) Organic matter consisting of husk, bran, chaff, straw, weed seeds and other inedible grains etc.

4 REQUIREMENTS

4.1 Description

4.1.1 Fortified rice shall be a blend of fortified rice kernels and polished raw or parboiled rice in the ratio of 1 : 100 or 2 : 100 with a tolerance limit of ± 10 percent of the declared ratio.

4.1.2 Fortified rice shall meet the requirements given in Table 1 and fortified rice kernels shall meet the requirements specified in IS 17782.

4.1.3 Fortified rice shall contain micronutrients in the limits specified in Table 2.

4.1.4 Fortified rice kernels shall be uniformly distributed in fortified rice.

4.1.5 Fortified rice shall be free from added colouring matter, foreign matter, metal pieces, mold, weevils, obnoxious substances, discolouration, poisonous seeds, rodent hair, excreta, and all other impurities except the limits specified in Table 1.

4.2 Pesticides/insecticides residues, poisonous metals, naturally occurring toxic substances and other contaminants (if any) in fortified rice shall not exceed the limit as prescribed in the *Food Safety and Standards (Contaminants, Toxins and Residues) Regulations, 2011*.

4.3 Fortified rice shall be manufactured in premises built and maintained under hygienic conditions (see IS 2491) following Good Manufacturing Practices (GMP)/Good Hygienic Practices (GHP) protocols given in Annex B.

4.4 In addition to above, fortified rice may also contain micronutrients in the limits specified in Table 3.

Table 1 Requirements for Fortified Rice
(Clauses 4.1.2 4.1.5 and 8.1)

Sl No.	Characteristic	Requirement		Method of Test, Ref to
		Milled Rice	Milled Parboiled Rice	
(1)	(2)	(3)	4	(5)
i)	Moisture content, percent by mass, <i>Max</i>	15.5	15.5	IS 4333 (Part 2)
ii)	Foreign matter ¹⁾	0.2	0.2	Annex A
	(a) Inorganic, percent by mass, <i>Max</i>	0.8	0.8	
	(b) Organic, percent by mass, <i>Max</i>			
iii)	Weevilled kernels, percent by mass, <i>Max</i>	5.0	5.0	IS 4333 (Part 1)
iv)	Heat – Damaged Kernels, percent by mass, <i>Max</i>	5.0	8.0	IS 4333 (Part 1)
v)	Damaged Kernels, percent by mass, <i>Max</i>	5.0	8.0	IS 4333 (Part 1)
vi)	Kernels with pin point, percent by mass, <i>Max</i>	4.0	4.0	IS 4333 (Part 1)
vii)	Immature Kernels, percent by mass, <i>Max</i>	0.5	0.5	IS 4333 (Part 1)
viii)	Chalky Kernels, percent by mass, <i>Max</i>	5.0	0.1	IS 4333 (Part 1)
ix)	Uric acid, mg/kg, <i>Max</i>	100	100	IS 4333 (Part 5)
x)	Aflatoxin B ₁ , µg/kg, <i>Max</i>	10	10	IS 16287

NOTE — Sample size of 25 g to 50 g shall be used for testing parameters at Sl No. (iii), (iv), (v), (vi), (vii) and (viii).

¹⁾ In foreign matter, the impurities of animal origin shall not be more than 0.10 percent by mass

Table 2 Requirements for Level of Fortification (Mandatory Fortificants)
(Clauses 4.1.3 and 8.1)

SI No.	Micronutrient	Chemical Form of Micronutrient	Fortification level	Method of Test, Ref to
(1)	(2)	(3)	(4)	(5)
i)	Iron, mg/kg	Micronized ferric pyrophosphate OR; Sodium iron (III) ethylenediamine tetraacetate trihydrate (Sodium feredetate- NaFeEDTA)	28 to 42.5 14 to 21.25	AOAC 944.02 or AACC 40-70.01 (total iron present in ferric form) by Atomic Absorption Spectroscopy or Spectrophotometry or AOAC 984.27 using ICP Emission
ii)	Folic acid, µg/kg	Folic acid	75 to 125	AOAC 992.05
iii)	Vitamin B ₁₂ , µg/kg	Cyanocobalamine or hydroxycobalamine	0.75 to 1.25	IS 16640

Table 3 Requirements for Level of Fortification (Optional Fortificants)
(Clauses 4.4 and 8.1)

SI No.	Micronutrient	Chemical Form of Micronutrient	Fortification level	Method of Test, Ref to
(1)	(2)	(3)	(4)	(5)
i)	Zinc, mg/kg	Zinc oxide (ZnO)	10 to 15	AOAC 984.27 (using ICP emission spectroscopy) or AACC 40-70.01 (using atomic absorption)
ii)	Vitamin A, µg/kg	Retinyl palmitate	500 to 750 RE	IS 16639
iv)	Thiamine (vitamin B ₁), mg/kg	Thiamine hydrochloride or Thiamine mononitrate	1 to 1.5	AOAC 2015.002 or AACC 86-80.01 (total thiamin, thiamin phosphate, thiamin diphosphate, and thiamin triphosphate)
v)	Riboflavin (vitamin B ₂), mg/kg	Riboflavin or riboflavin 5'-phosphate sodium	1.25 to 1.75	J.AOAC Int. 2009; 680-687
vi)	Niacin (vitamin B ₃), mg/kg	Nicotinamide or nicotinic acid	12.5 to 20	AOAC 2015.003 or AACC 86-90.01
vii)	Pyridoxine (vitamin B ₆), mg/kg	Pyridoxine hydrochloride	1.5 to 2.5	EN 14164

NOTE — Approved International standard test methods from organizations like ISO/APHA/ASTM/APAC/EPA/EN may also be followed.

5 PACKING

5.1 The product may be packed in bags of food grade jute (*see* IS 12650) or high density polyethylene (HDPE)/ polypropylene (PP) woven sacks (*see* IS 16208).

Bags shall have a heat cut mouth to prevent fibrillation and have sewn, single fold bottom. Bags shall be closed by double stitching with suitable thread. Bags shall be clean, sound and free from insect/fungal Infestation. Construction of fabric shall be solid to sustain harsh handling.

In case of HDPE/PP bags, packaging material shall be flexible, puncture and breakage resistant with water vapour transmission rate (WVTR) 20 to 50 g/m²/day

when tested as per method specified in ISO 2528 and oxygen transmission rate (OTR) 8 to 1.9 cc/m²/day as per method specified in ISO 15105 (Part 2).

5.2 The product shall be packed in quantities as stipulated under the *Legal Metrology (Packaged Commodities) Rules*, 2011 as well as in accordance with requirements under the *Food Safety and Standards Act*, 2006 and the Rules framed thereunder.

6 MARKING

6.1 The ink used for marking shall be of such quality which may not contaminate the product. Each package shall be suitably marked legibly and indelibly to give the following information:

- a) Name of the product;
- b) Fortification logo (F + logo) as per *Food Safety and Standards (Fortification of Foods) Regulations, 2018*;
- c) Blending ratio;
- d) Name and address of the manufacturer/blender/packer;
- e) Date of packing;
- f) Lot/batch number;
- g) Net quantity;
- h) Best before.....month.....year;
- j) List and levels of the micronutrients along with their chemical form;
- k) Advisory/instructions for storage and cooking;
- m) Statement of “People with Thalassemia may take under medical supervision”; and
- n) Any other information required under the *Legal Metrology (Packaged Commodities) Rules, 2011, the Food Safety and Standards (Labelling and Display) Regulations, 2020*.

6.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

7 SAMPLING

Representative samples of the material for ascertaining conformity to the requirements of this standard shall be drawn according to the method given in IS 14818.

8 TESTS

8.1 All the tests shall be carried out as specified in *col 5* of Table 1, *col 5* of Table 2 and *col 5* of Table 3.

8.2 Quality of Reagents

Unless specified otherwise, pure chemicals shall be employed in tests and distilled water (*see* IS 1070) shall be used where the use of water as a reagent is intended.

NOTE — ‘Pure chemicals’ shall mean chemicals that do not contain impurities which affect the test results.

ANNEX A

[Table 1, Sl No. (ii)]

DETERMINATION OF FOREIGN MATTER (ORGANIC AND INORGANIC)

A-1 APPARATUS

A-1.1 Physical Balance, 5 mg sensitivity.

A-1.2 Sieves — The following four IS Sieves of round holes shall be used [see IS 460 (Part 1)]:

	<i>IS Sieve</i>
Top	4.00 mm
Second from top	3.35 mm
Third from top	1.70 mm
Fourth from top	1.00 mm

A-1.2.1 A solid bottom pan shall be used at the bottom.

A-2 PROCEDURE

For the purpose of reducing the quantity of the test sample, spread the entire sample in a tray, divide it into four equal portions, collect the two opposite portions and repeat this process till the required quantity of sample is obtained.

Take 250 g of sample. Pour the quantity over the set of sieves previously arranged in a way so that the sieve with the largest perforations comes at the top and those with smaller perforations are placed in order of their sizes. Then, agitate the sample thoroughly to strain out the foreign matter at various levels. As a result of this straining, other foodgrain and foreign matter like bolder pieces of clay, chaff etc., would remain on the first three sieves according to their sizes. The topmost sieve would contain bold grains, big pieces of clay and other big sized foreign matter, while the lower sieves would contain smaller foreign matter. Separate the sieves after straining and pick up all foreign matter by hand or forceps from each of them and add it to the foreign matter collected on the bottom pan.

Put the entire foreign matter collected as above into a beaker containing carbon tetrachloride. The inorganic extraneous matter will settle down which can be separated from the organic foreign matter. Remove the organic foreign matter, dry and weigh. Calculate the percentage. Remaining amount shall be the inorganic foreign matter.

ANNEX B

(Clause 4.3)

GMP/GHP PROTOCOLS FOR BLENDING OF FORTIFIED RICE KERNELS (FRK) WITH RAW/ PARBOILED RICE AND ITS PACKAGING

B-1 BLENDING

Blending of FRK in raw and parboiled rice to obtain fortified rice.

B-1.1 Procedure

Check overall cleanliness of the hopper, feeding unit, mixing unit, and receiver. Check the setting of the feeding unit and set the feed rate as per requirement. For example, in a screw feeder, set the speed of FRK and raw or parboiled rice feeder as well as of a mixer. In batch blending, monitor the weight of FRK and raw or parboiled rice before mixing and operate the mixer at a predetermined speed to obtain uniform homogeneity. In continuous blending, monitor the flow rates of the FRK and raw or parboiled rice to obtain uniform homogeneity.

B-1.2 Specification of Fortified Rice

Fortified rice shall conform to the specifications given in 4.

B-1.3 Potential Hazards and Remedies

Potential hazards	GMP/CCP	Remedies
Non-homogenous mixing	Good manufacturing practices (GMP)	Check the predetermined flow rate of rice, and FRK. Operate mixing chamber at predefined process conditions.
Metal parts	Critical control points (CCP)	Visual inspection and use of magnetic detector

B2 PACKAGING**B-2.1 Procedure****B- 2.1.1 Form Fill And Seal (FFS) Packaging**

Check overall cleanliness of hopper, rolls, packaging film, feeding cups, heater, conveyor belt, etc. Check the temperature of the horizontal and vertical sealer. Sealing temperature depends on the packaging film. Mount the packaging roll carefully. Adjust the packaging film at the vertical sealing heater and horizontal sealing heater. Check the required air pressure. Switch on the packaging machine and set the temperature of horizontal and vertical sealing heaters. Load the fortified rice in the hopper and cover it with a lid to avoid cross-contamination. Start the packaging operation and collect the packaged fortified rice pouches (approximately 1 to 5 kg) and pack them in the boxes.

B- 2.1.2 Manual Packaging

For bag packaging, the fortified rice shall be stored in the storage tank and packed in suitable packaging bags as described in 5. All operations shall be carried in a hygienic environment and using personnel safety protocols.

B-2.2 Potential Hazards and Remedies

Potential hazards	GMP/CCP	Remedies
Incorrect weight	Good manufacturing practices (GMP)	Check weighing balance, predetermine the flow rate
Metal/foreign bodies	Critical control points (CCP)	Pass the pouches through metal detectors

ANNEX C

(Foreword)

COMMITTEE COMPOSITION

Foodgrains, Allied Products and Other Agricultural Produce Sectional Committee, FAD 16

<i>Organization</i>	<i>Representative(s)</i>
Directorate of Marketing and Inspection, Ministry of Agriculture, New Delhi	DR VIJAYA LAKSHMI NADENDLA (Chairperson) SHRI P. K. SWAIN (Former Chairperson)
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Panel on Specifications for Fortified Rice Kernels, FAD 16/Panel 7

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